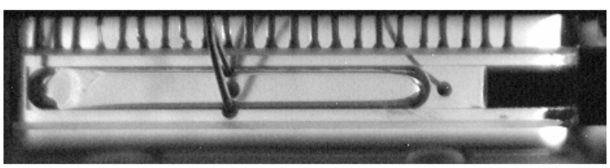
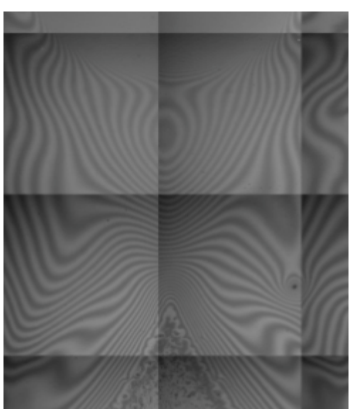
ISS and Human Research Project Office Highlights
April 9, 2010

<u>ISS Research Program</u>

Completion of Successful Science Operations for Constrained Vapor Bubble (CVB) on International Space Station (ISS): Science operations for CVB 30mm Pentane module, the first payload to operate on the Fluids Integrated Rack (FIR) began on March 22, 2010 and completed on April 1, 2010, 24/7 after received the permission to extend 3 more day's operations. The team accomplished extraordinary success: (1) Due to the absent of gravity induced natural convection both inside and outside the CVB, a new and simpler set-up to study basic interfacial science has been achieved; (2) The study of a simple wickless heat pipe specifically designed for micro-gravity has been achieved, and using these results, the preliminary design of a heat exchanger for microgravity can be started; and (3) Since the process appears more stable in microgravity than in the earth's gravitational field, a larger range of heat fluxes can be studied. The team is looking forward to starting operations with the CVB dry/calibration module after April 19, 2010. (POCs: RET/David F. Chao, 3-8320; MAH/Ronald Sicker, 3-6498)



CVB 30mm cell with bubble and thermocouples from surveillance camera



Part of a microscopic image mosaic that of change from liquid to vapor.

FLEX-2 Drop Tower Tests Begin This Week.
New FLEX-2 drop tower tests using flight fuels are scheduled for 7-8 April. An evaluation of the design will be made on 8 April following the drop tests. Depending on the success or lack thereof of good burns without nucleation, new fiber may be sputtered with elemental gold or chromium instead of silicon carbide to increase the smoothness of the fiber. If needed, the new fiber will be sputtered late the week of 12 April.

New igniter designs for the beaded fiber arrays have been designed and successfully tested in a benchtop configuration. Drawings for the igniter are in release cycle. A subassembly of the igniter system may be done in house or via an outside vender. Verification testing using a flight-like configuration is pending. Flight igniters should be available by mid-May. Combustion by-product testing is being planned to satisfy hazard analysis and in response to a Critical Design Review (CDR) Request for Action (RFA).

Pre-ship reviews are being planned prior to shipping FLEX-2 ISS hardware for both the ULF-5 and ATV-2 launches. An Engineering Systems Acceptance Review for the igniter assemblies and the fiber assembly kits is scheduled for 27 May, and the Executive SAR is scheduled for 8 June. (POC: J. Mark Hickman, (216) 977-7105)

CFE-2 units launched on Flight 19A (STS-131)
Four experiment units for the Capillary Flow Experiments-2 (CFE-2) were launched on STS-131 on April 5, 2010. The four experiment units are Vane Gap 1 (VG1), VG2, Interior Corner Flow 1 (ICF1), and ICF2. These four units were refurbished from the CFE-1 project to further enhance the dataset from CFE-1. In particular, VG1 and VG2 contain new perforated capillary vanes, and ICF1 and ICF2 contain different fluid volumes and viscosities of the working fluid.

The CFE-2 flight experiment consists of a total of 11 handheld experiment units with various test geometries to investigate the behavior of capillary flow phenomena in geometries found in capillary vanes, screens, and wicking structures. The working fluid is silicone oil of various viscosities, depending on the individual unit geometry. The results of CFE-2 have applications in propellant management for fluid storage tanks, thermal control systems, and advanced life support systems for spacecraft. The Principal Investigator for CFE-2 is Prof. Mark Weislogel at Portland State University.

The CFE-2 flight experiment is funded by the Exploration Technology Development Program (ETDP) under the ISS Research Project. (POC: RET\Robert D. Green 3-5402)

CSLM-2 Aboard Shuttle Discovery on STS-131 Mission: An unprecedented set of low volume fraction coarsening experiments, which will provide coarsening kinetics data that can be directly compared to untested theories, was launched aboard shuttle Discovery flight 19A/STS-131 on April 5, 2010 for the 33rd mission to ISS. The Coarsening of Solid-Liquid Mixtures-2 (CSLM-2) is a materials science experiment designed to study the kinetics of competitive particle growth of tin in a lead-tin eutectic liquid. Coarsening occurs on Earth during the processing of any metal alloy and thus the coarsening process affects products from dental fillings to turbine blades. However, Earth's gravity can induce particle sedimentation and thus hamper the studies of coarsening in solid-liquid mixtures. The microgravity environment of the International Space Station (ISS) will eliminate buoyancy effects and allow the study of the process of coarsening with reduced interference from the sedimentation that occurs on Earth.

Previous experiments on ISS have focused on high volume fraction samples due to concern that background g-jitter could potentially lead to particle motion and thus an enhancement of the coarsening kinetics over that predicted by a theory for diffusion-limited coarsening. Analysis of experiments conducted on ISS and Shuttle have shown no evidence of enhanced coarsening rate which indicates that the background environment is acceptable to conduct coarsening experiments at low volume fractions. These results are used to design a set of experiments in the low volume fraction region which will provide data that, for the first time, can be compared directly to theory with no adjustable parameters. The results will be used to test computer codes for the design of new materials and address the long-standing controversy over the dependence of the coarsening rate of a two-phase system on the volume fraction of the coarsening phase. (POCs: RET/Walter Duval, 3-5023; MAH/Robert Hawersaat, 3-8157)

Human Research Program

Intravenous Fluid Generation (IVGEN) Experiment Launched Aboard STS-131: The IVGEN experiment was launched aboard STS-131 on April 25, 2010. This experiment will demonstrate the capability to purify water, and then mix the water with salt crystals to produce normal saline to the standards required for intravenous injection. This prototype hardware, which will allow flight surgeons more options to treat ill or injured crew members during future long-duration space exploration missions, will generate up to 9 liters of purified water and 3 liters of normal saline solution. The normal saline solution will be returned to earth to determine compliance with the United States Pharmacopeia standards for IV solutions. (POCs: REB/Terri McKay, 3-8781, RET/John McQuillen, 3-2876)